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In prerevolutionary days Russia's metallurgical industry supplied machine building on the open market policy which is characteristic of all capitalist metallurgy. As a result, machine building got very little metal, most of it going to transport, construction, and other uses. Under the Soviet government, metallurgy has been completely reoriented, the largest part of its output now going into machine building. Much remains to be done, however, to achieve full coordination between the two branches of industry. In particular, the lag in the production of sheet metal and of special shaped profiles of rolled iron (spetsial'nykh fasonnykh profiley probata) must be overcome. USSR machine building likewise suffers from an over-diversity of production, confused nomenclature, and the need for too many varieties of metal.

These deficiencies can and must be eliminated in the immediate future. The metallurgical industry must supply machine building with the various grades of metal corresponding to its technical demands, but machine building must in turn simplify its demands on metallurgy. Along with standardizing of models and parts, the machine-building industry must standardize the grades of metal it requires.

The labor-consuming processes in machine building could be considerably lightened if metallurgical enterprises would supply machine building with more finished stock (not requiring the removal of filings, for instance). Greater accommodation of the demands of machine building would represent comparatively small additional cost to the metallurgical enterprises, and this distribution of labor between the two branches would materially improve the labor productivity in machine building and in all industry.

The 30-percent increase in the output of rolled iron to be achieved by 1950 will permit the production of a considerably more diverse assortment of stocks. The re-opening of the Zaporozh'ye Steel Plant and the activation of the sheet mills at Magnitogorsk and other plants will greatly increase the production of sheet metal. These factors, together with a standardization of demands for various grades, should soon be reflected in a substantial increase in labor productivity in the machine-building industry. There is also great significance for machine-building labor productivity in the use of pipe for the manufacture of axles in the construction of railroad cars (such as is being done at the Ural Railroad Car Plant) and the receipt by automobile plants of finished front axles from metallurgical plants such as the Metallurgical Plant named Petrovskiy.

A planned allocation of labor among the branches of the machine-building industry and its related activities is taking place. Branches requiring much expenditure of labor are being transformed in branches requiring less. For example, intensification of the mass production of spare parts will lead to a sharp curtailment of labor expenditure in the highly labor-consuming repair branches where labor productivity is 5-6 times lower than in the producing end of machine-building.

A number of authors have pointed out that labor productivity in the manufacture of machine tools can be increased 3-4 times if plants would specialize in the production of separate parts of multipurpose machine tools. The exemption of a large number of plants from production of parts for their own use, and the concentration of such production in other specialized plants should have considerable effect. Centralization of the production of reinforcing materials, screws, pins, nuts, washers, cotter pins and rivets permits, with the use of cold heading (kholodnaya vyсадка) instead of machining in turret lathes, 33 times the former productivity of labor in making bolts, 95 times the productivity in making screws and 6 times the productivity in making nuts.

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Machine building in the USSR is one of the most advanced branches of industry. But even here there are many possibilities of increasing mechanization and making more processes automatic. The number of workers performing manual labor in machine-building enterprises is still considerably larger than that in a number of other branches of industry. The amount of equipment per worker is about three times lower than in the metallurgical and chemical industries. Even in such advanced and highly mechanized machine-building plants as automobile plants, manual workers make up about half the personnel of the plant. Labor processes in the subsidiary shops of machine-building enterprises are especially under mechanized.

In machinery repair shops and other subsidiary shops in automobile plants, scraping amount to 25 percent of all labor, while in machinery repair, assembly, tool, and other shops, fitting (slesarnyy) operations comprise 20 percent of all labor. The number of operations carried out mechanically in some very large and highly mechanized plants, such as the Ural Railroad Car Plant, is not over 30 percent of the total number of operations involved in basic production.

The USSR machine tool park will be twice as large in 1950 as in 1940. There will be 4.5 times as many types of machine tools (from 500 types in 1940 to 2,300 in 1950), and the composition of the park will be radically improved. The use of highly productive special-purpose, aggregate (agregatnyy), automatic, multibladed (mnogorudnyy) and multipurpose machine tools will increase, and automatic machine tool lines will be put into operation. The power and the speed of operation of machine tools will radically increase. The use of attachments (prispособleniye) will expand sharply. Industry will be saturated with machine tools, and particularly with those guaranteeing super-speed work methods.

The use of control, measuring, and other automatic devices will increase to an enormous degree.

The doubling of the machine tool park by 1950 means that the amount of equipment per worker (vooruzhennost') will increase by a factor of 1.5, thus exceeding the level of the US workers' machine-tool equipment. The percentage of modern, highly productive machine tools in the basic machine shops of USSR automobile plants will increase from 20-30 percent in 1945 to 60-70 percent in 1950.

In accordance with the Five-Year Plan, the output of special and aggregate machine tools in 1950 will be 9.5 times the prewar level, and will reach 12,300 tools. The increase in total output of machine tools will be $1\frac{1}{2}$ times. Automatic aggregate machine tools, working on the principle of multitool and multiposition machining, assure a labor productivity increase of 10-15 times (in some cases 50-60 times) in comparison with conventional universal machine tools. The 1950 output of 12,300 special and aggregate machine tools out of a total of 74,000 tools means at least a doubling of the total productive capacity of the tools produced that year.

The utilization of automatic lines cuts the time of manufacture 10-15 times, and in some cases even more. The introduction of the automatic line means a genuine technical revolution in production. Dozens of automatic machine tool lines will go into operation in the near future. In automobile plants alone, 38 such lines will be in operation by the end of the Five-Year Plan.

The planning and construction (sozdaniye) of automatic shops and plants for the manufacture of automobile and tractor pistons and piston pins have been begun.

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Increased speed of operation is another factor affecting labor productivity in the machine-building industry. The rate of spindle revolution in the thread-milling machine made by the "Krasny Proletariy" Plant was 320 rpm in 1930-1935. This was raised to 600 rpm in 1942-1944, and in 1947 to 3,000 rpm.

Experience has shown that improving the design of a machine can raise the productivity of the labor and cut the expenditure of material going into its manufacture $1\frac{1}{2}$ to 2, and even more, times. At the Ural Machine-Building Plant, for instance, a modification of the system used for joining excavator walls shortened the process from 60 to 10 machine-hours. At the Staro-Kramatorsk Heavy Machine-Building Plant, the time required for the mechanical operations in making the roller conveyor for a billet-cutting machine was reduced 39 percent by simplifying its design; a change in the design of the knife cut the time for that part's manufacture 68 percent. By simplifying the lubrication system of a sheet-bending mill, the time required for the manufacture of the system was reduced 65 percent.

At the Leningrad Metallurgical Plant (now Stalin), the conversion from cast to welded cylinders in the manufacture of high-pressure 100,000-kilowatt turbines cut the amount of labor required 52 percent, while the use of stamped blanks for valves cut labor and metal expenditure in that phase of the manufacture 30 percent.

The sharp increase in cutting speeds has been of great importance in raising productivity of labor. Instead of the old rate of 20-30 meters per minute, cutting of steels is now done at a rate of 2,000-7,000 meters per minute. Converting to high-speed grinding at the Gor'kiy Automobile Plant increased labor productivity 6 times. The machine time in milling was cut by a factor of 10 when high-speed milling was introduced.

Experience has shown that comparatively little change in a machine's design is needed for its conversion to high-speed operation. The conventional cutting tool must be replaced with one made of super-hard alloy designed according to the new geometry. At present, the USSR machine-building industry is almost completely equipped with tools of hard and super-hard alloys. Thus, the fastest conversion to high-speed and super-high-speed cutting is a vital job for the immediate future. It promises great increases in the labor productivity of the machine-building industry.

Another important factor is the simultaneous processing of many parts and the simultaneous processing of several sides of the same part. In making the cam shaft of the ZIS-110 automobile, the use of a multiblade cutting machine instead of a lathe cut machining time 43 times. Gang-drilling of girder assemblies at the Ural Railroad Car Plant made the process 5 times as fast.

Such new methods of machine processing as the anode-mechanical (anodno-mekhanicheskiy) and the erosional (erosionnyy) methods have come into use in USSR machine building. Production of hard alloy dies is 10-12 times less labor-consuming by the electro-erosional method. A cutting tool can be ground in 60-80 minutes by the anode-mechanical method, a process formerly requiring 4-7 hours by the conventional mechanical cutter-head method. Anode-mechanical grinding (pereshlifovka) of hard alloy dies and draw-plates cuts the time required for this operation from 3-4 hours down to 15-20 minutes.

All the advanced methods of casting, forging, and welding listed in the Law of the Five-Year Plan are being widely introduced in Soviet machine building.

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Metal utilization in plants must be improved. The coefficient of utilization of rolled iron in machine building does not exceed 70-75 percent, while in some cases it is as low as 30 percent. A high percent of waste metal not only indicates that the plant's consumption is too high, but that its use of labor and tools is inefficient. The cutting away of shavings, which represent 30-40 percent of the waste materials removed from a manufacturing shop of a machine-building plant, is also excessive.

Tremendous strides in the adoption of continuous conveyor-belt production methods have been made. At the Automobile Plant in ~~in~~ Stalin, conveyor production reduced the labor input 40 percent and cut the manufacturing time for one automobile 3 times.

Continuous methods and new automatic technology at the Ural Railroad Car Plant reduced the number of workers needed for axle machining 23 times, wheel machining 5.5 times and wheel couple assembly 13 times.

At the Ural Machine-Building Plant, the largest enterprise devoted to production of heavy machinery in units, series production cut labor input in drilling equipment manufacture 47 percent in 10 months of 1946.

At the Ural Railroad Car Plant, the introduction of piece-work-progressive remuneration tripled production in one shop and doubled it in another.

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